

TOSHIBA GaAs Linear Integrated Circuit GaAs Monolithic

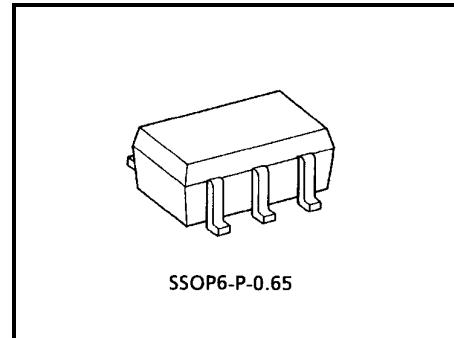
TG2211AFT

RF SPDT Switch

Antenna switch for Bluetooth class 2 and 3
 Antenna switch for diversity
 Switch for receive filters for mobile handsets
 Switch for local signals

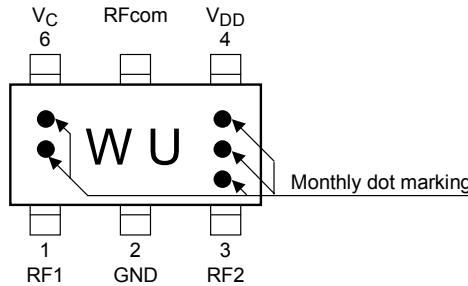
Features

- Small external circuit: Built-in inverter
- Low insertion loss : Loss = 0.45dB (typ.) @1.0 GHz
- High isolation : ISL = 25dB (typ.) @1.0 GHz
- Low voltage operation: VDD = VC (Hi) = 2.4 V (min.)
- Small package : SSOP6-P-0.65 (TU6) package
(2.0 mm × 2.1 mm × 0.6 mm)

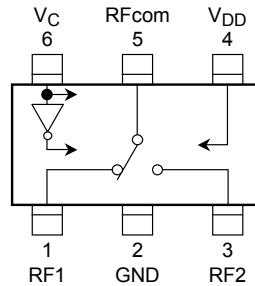


Weight: 0.0045 g (typ.)

Pin Configuration and Marking (top view)



Equivalent Circuit



Maximum Ratings (Ta = 25°C, Zg = ZI = 50 Ω)

Characteristic	Symbol	Conditions	Rating	Unit
Supply voltage	V _{DD}	P _i ≤ 15 dBmW	-0.5 (min.) / 6 (max.)	V
Control voltage	V _C	P _i ≤ 15 dBmW, V _C - V _{DD} ≤ 1.5 V	-0.5 (min.) / 6 (max.)	V
Input power	P _i	V _{DD} = 2.4 ~ 2.7 V, V _C = -0.2 ~ 3.3 V	25	dBmW
Total power dissipation	P _D	(Note 1)	250	mW
Operating temperature range	T _{opr}	—	-40 ~ 85	°C
Storage temperature range	T _{stg}	—	-55 ~ 150	°C

Note 1: When mounted on a 20 mm × 24 mm × 0.4 mm double-sided Teflon printed circuit board (the entire reverse side is a ground connection) at Ta = 25°C.

Caution

This product is a Lead (Pb)-free article.

This device is sensitive to electrostatic discharge. When handling this product, ensure that the environment is protected against electrostatic discharge by using an earth strap, a conductive mat and an ionizer.

See Note 5 for the power supply sequencing requirement.

Electrical Characteristics

$V_{DD} = 2.4 \sim 2.7 \text{ V}$, $V_C(\text{Hi}) = 2.4 \sim 3.3 \text{ V}$, $V_C(\text{Lo}) = 0 \text{ V}$, $T_a = 25^\circ\text{C}$, $Z_g = Z_l = 50 \Omega$, unless otherwise stated.

Characteristic		Symbol	Test Conditions		Min	Typ	Max	Unit	
Insertion loss	Loss (1)		$f = 1.0 \text{ GHz}$, $P_i = 0 \text{ dBmW}$	—	0.45	0.75		dB	
	Loss (2)		$f = 2.0 \text{ GHz}$, $P_i = 0 \text{ dBmW}$	—	0.5	0.8			
	Loss (3)		$f = 2.5 \text{ GHz}$, $P_i = 0 \text{ dBmW}$	—	0.6	0.85			
Isolation	between RFcom and RF1	ISL (1)	$f = 1.0 \text{ GHz}$, $P_i = 0 \text{ dBmW}$	20	25	—		dB	
		ISL (2)	$f = 2.0 \text{ GHz}$, $P_i = 0 \text{ dBmW}$	20	25	—			
		ISL (3)	$f = 2.5 \text{ GHz}$, $P_i = 0 \text{ dBmW}$	20	24	—			
	between RF1 and RF2	ISL (4)	$f = 1.0 \text{ GHz}$, $P_i = 0 \text{ dBmW}$	20	25	—			
		ISL (5)	$f = 2.0 \text{ GHz}$, $P_i = 0 \text{ dBmW}$	17	20	—			
		ISL (6)	$f = 2.5 \text{ GHz}$, $P_i = 0 \text{ dBmW}$	14	17	—			
Input power at 1dB compression point (Note 3)		$P_{11dB}(1)$	$f = 1.0 \text{ GHz}$ (Note 2)	17	23	—		dBmW	
		$P_{11dB}(2)$	$f = 2.0 \text{ GHz}$ (Note 2)	17	23	—			
		$P_{11dB}(3)$	$f = 2.5 \text{ GHz}$ (Note 2)	16	22	—			
Supply current	I_{DD}	No RF signal (Note 2)	—	0.20	0.35	mA			
Control current	I_C	No RF signal (Note 2)	—	0.03	0.05	mA			
Switching time	t_{sw}	$f = 100 \text{ MHz}$, $P_i = 0 \text{ dBmW}$	—	80	200	ns			

Note 2: When $V_{DD} = 2.7 \text{ V}$, $V_C(\text{Hi} / \text{Lo}) = 2.7 \text{ V} / 0 \text{ V}$.

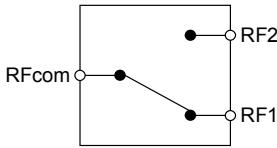
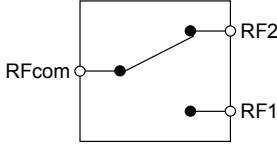
Note 3: P_{11dB} is the input power level when the insertion loss increases by 1 dB from that of the linear range.

Recommended Operating Range ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Min	Typ	Max	Unit
Supply Voltage	V_{DD}	2.4	—	2.7	V
Control voltage	$V_C(\text{Hi})$	2.4	—	3.3	V
	$V_C(\text{Lo})$	-0.2	0	0.2	V
Voltage difference	$V_{DD} - V_C(\text{Lo})$	2.4	—	2.9	V
	$V_C(\text{Hi}) - V_{DD}$	-0.2	0	0.6	V

Note 4: Always apply a voltage within the recommended range to V_{DD} pin when the device is operating, i.e. when any voltage other than 0 V is applied to V_C pin or RF signal is input to any RF port.

Switch Condition ($V_{DD} = 2.4 \sim 2.7 \text{ V}$)

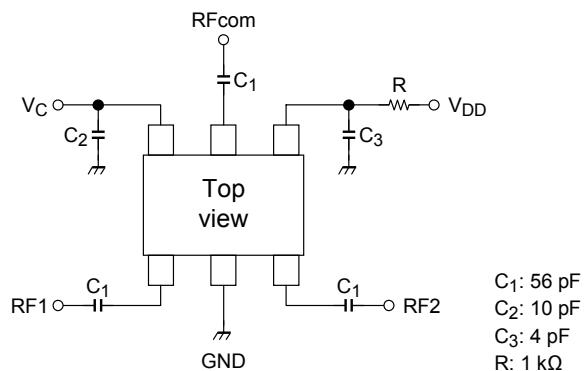
V_C Voltage Level	Internal Connection	RFcom – RF1	RFcom – RF2
High		ON	OFF
Low		OFF	ON

Pin Description

Pin No.	Symbol	Description
1	RF1	RF port. Connected to RFcom when V_C = High. Connect the capacitor (C_1) to block internal DC voltage of the IC.
2	GND	GND pin. Connect to the ground pattern of the circuit board.
3	RF2	RF port. Connected to RFcom when V_C = Low. Connect the capacitor (C_1) to block internal DC voltage of the IC.
4	V_{DD}	Power supply and RF-GND pin. Must be RF-grounded via the capacitor (C_3), and should be done as close as possible for better RF performance. The value of the capacitor significantly affects the isolation. Connect the resistor (R) behind the capacitor to block RF leakage. Apply a voltage within the recommended range of V_{DD} to the far end of the resistor.
5	RFcom	RF port. Connection can be switched to RF1 or RF2 by varying the level of the voltage applied to the V_C pin. Connect the capacitor (C_1) to block internal DC voltage of the IC.
6	V_C	Switch connection control pin. The switch connections can be controlled by varying the level of the voltage to this pin. Connect the bypass capacitor (C_2) to the pin.

Note 5: This device requires the power supply sequencing in which V_{DD} is powered up first and powered down last. Always apply a voltage within the recommended range to V_{DD} pin when the device is operating, i.e. when any voltage other than 0 V is applied to V_C pin or RF signal is input to any RF port.

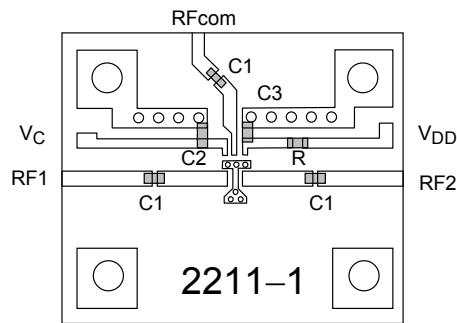
RF Test Circuit



The values of external capacitors and resistor should be chosen to accommodate the operation frequency, bandwidth, switching speed and the pattern layout of the actual circuit board in the user's system. Be sure to take this into consideration when designing circuits.

List of External Components for Reference

	50~300 MHz	300~500 MHz	0.5~2.5 GHz	Chip Series	
C_1	1000 pF	100 pF	56 pF	GRM1552C1H series	MURATA
C_2	100 pF	10 pF	10 pF	GRM1552C1H series	MURATA
C_3	100 pF	100 pF	4 pF	GRM1552C1H series	MURATA
R	1 k Ω	1 k Ω	1 k Ω	MCR01MZSJ series	ROHM

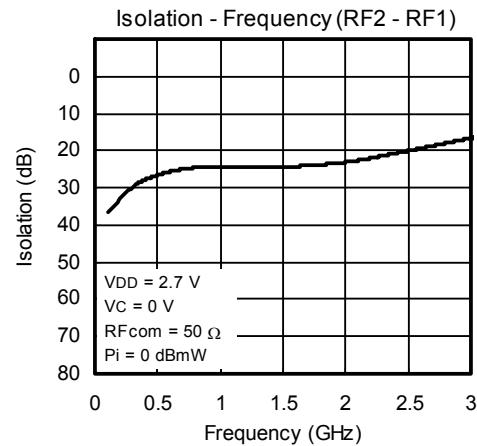
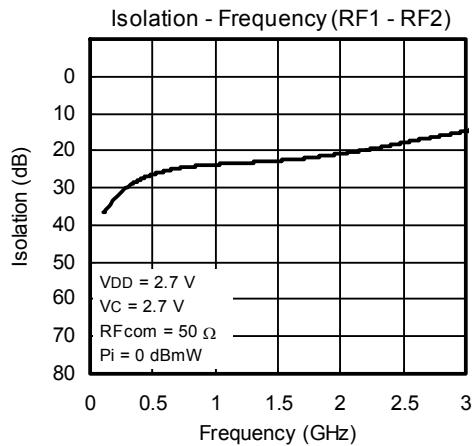
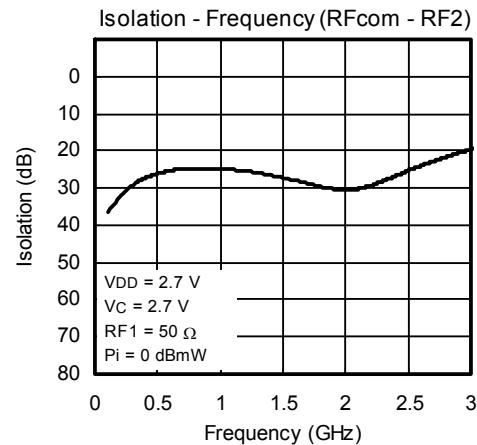
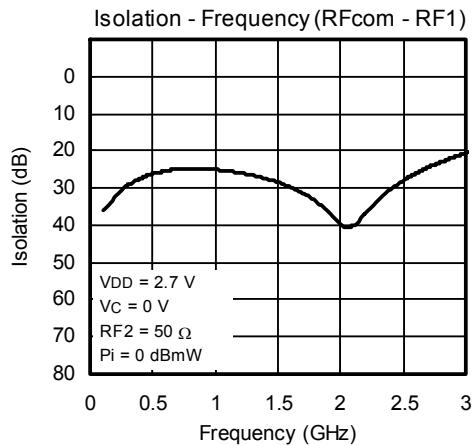
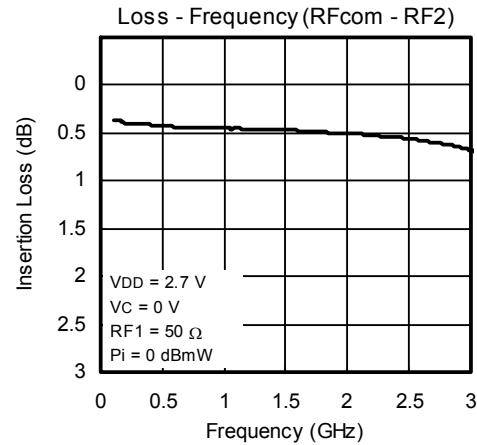
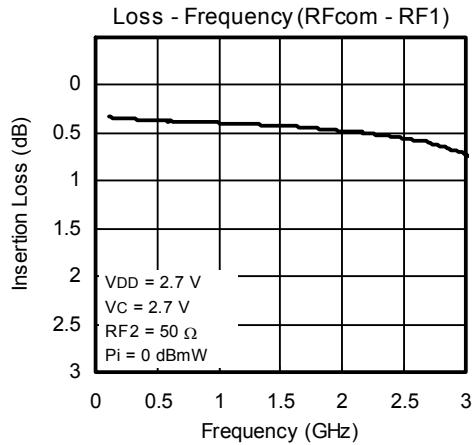
Evaluation Board**Notice**

The circuits and measurements contained in this document are given in the context of example applications of the product only.

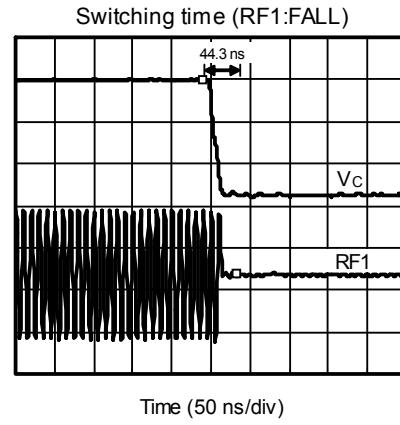
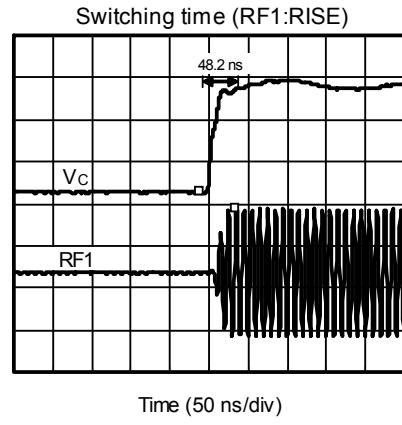
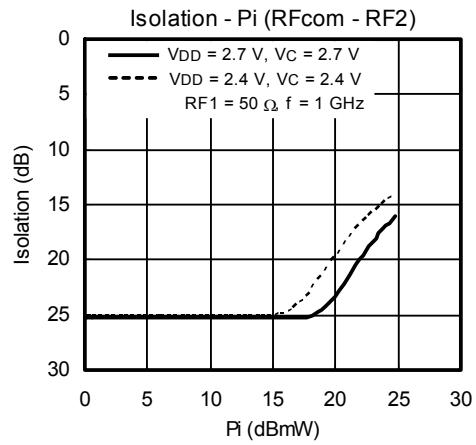
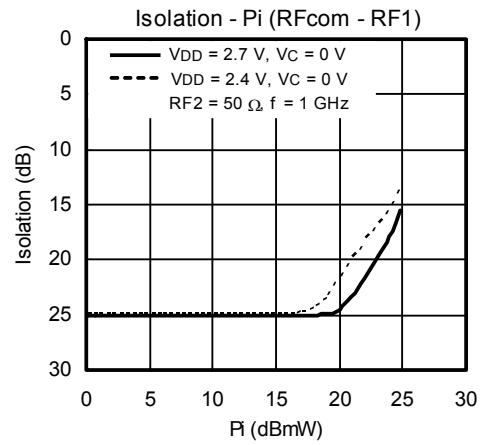
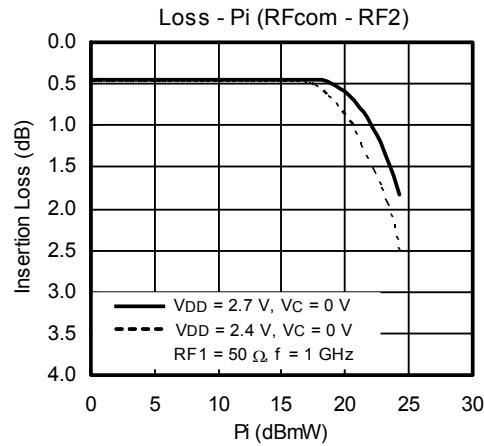
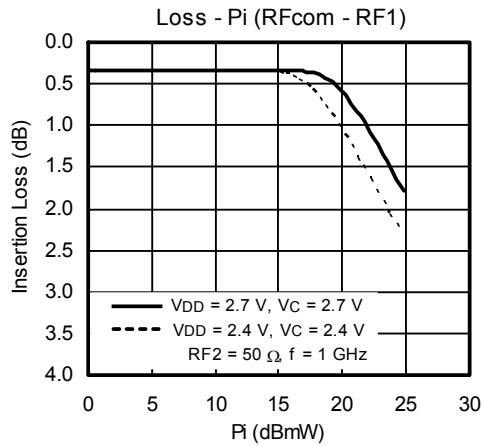
Moreover, these example application circuits are not intended for mass production since the high-frequency characteristics (i.e., the AC characteristics) of the device will be affected by the external components that the customer uses, by the design of the circuit and by various other conditions.

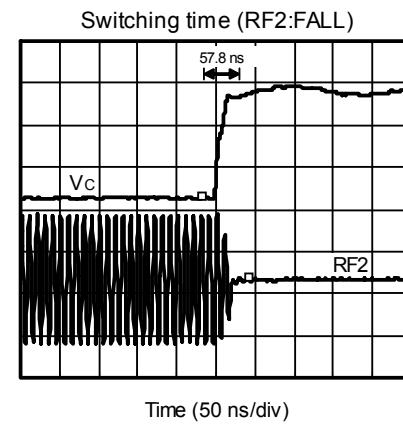
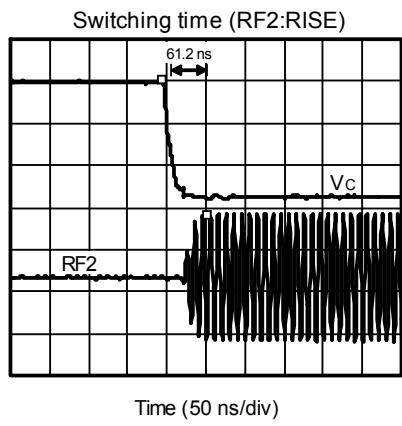
It is the responsibility of the customer to design external circuits that correctly implement the intended application and to check the characteristics of the design.

TOSHIBA assumes no responsibility for the integrity of customer circuit designs or applications.

Typical Operating Characteristics

Typical Operating Characteristics (continued)

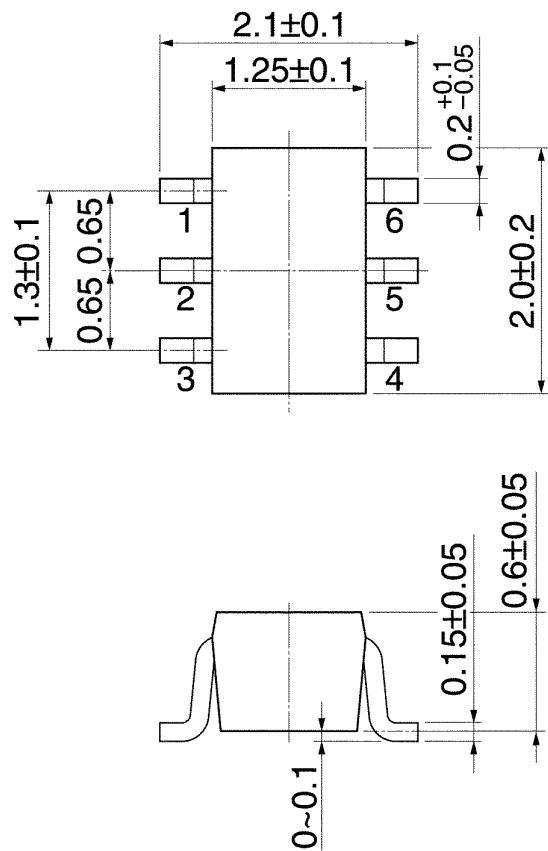


Typical Operating Characteristics (continued)

Package Dimensions

SSOP6-P-0.65

Unit: mm



Weight: 0.0045 g (typ.)

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